

## Element Extraction in Packaging Design of Cireng Rujak X with Kansei Engineering Method

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### ABSTRACT

Frozen Cireng Rujak is popular for its practicality, but the packaging of Cireng Rujak X still has many shortcomings that affect its quality. These issues arise from packaging that cannot be resealed and labels that are easily damaged. This research aims to determine the elements and design outcomes of Cireng Rujak X packaging based on consumer preferences. The study employs the Kansei Engineering method to understand consumer perceptions of the packaging. This method is supported by Quantification Theory Type-1 (QTT-1) to identify design elements. The selected concept based on QTT-1 is "Unprotection-Simple" with a score of 0.921. The resulting design elements include No Lid (X1.7), Flat Bottom shape (X2.8), Ziplock feature (X3.2), Aluminum Foil material (X4.8), Large volume (X5.3), Minimalist design style (X6.2), surface design using Labels or Stickers (X7.2), and Informative label design (X8.1). The mock-up design based on the selected concept aligns with consumers' emotional preferences.

**Keywords:** Cireng Rujak, frozen food, product development, Kansei Engineering, Quantification Theory Type-1(QTT-1).

### Introduction

Packaging design development that prioritizes consumer desires is becoming increasingly important in today's industry. Consumers are not only concerned with functionality but also seek new experiences in buying a product with a unique and attractive design that differentiates it from other products [1]. Packaging design that is in accordance with consumer desires becomes important to instill a brand image in the minds of consumers [2]. Therefore, packaging design that considers consumers' emotions not only protects the product, but also serves as a communication tool to consumers.

Elements in design have an important role in creating effective and aesthetic visual

communication. Design elements such as color, text, and visual elements are interconnected. Complement to provide information and shape consumer perceptions of the product [3]. Elements can give a certain psychological impression seen by the eye, it can convey a certain impression or meaning [4]. A designer can produce visually appealing work while conveying the desired information and purpose by using the right elements.

Elements in design play a crucial role in representing a concept. Each element has the ability to convey deep emotions and messages contained in a concept. For example, colors are used to describe the atmosphere in a design, even later colors can affect a person's mood [5].

Concepts are used to create a strong identity and elements are used to provide an understanding of the concept [6].

The Quantification Theory Type-1 (QTT-1) method is applied to determine packaging design elements based on the results of the design concept. This method has the ability to analyze the relationship between design elements and concepts [7][8]. The design concept has been obtained previously by Principal Component Analysis Methods (PCA), namely PC1 "Unprotection-Simple". The concept is based on the Kansei Engineering method which offers an innovative approach to designing packaging based on consumers' emotional preferences [9].

Recent research in packaging design shows a gap between traditional approaches and consumers' emotional needs. Several recent studies have found that many food packaging is still designed with a focus on basic functions without considering the emotional experience of users [10]. Based on Muhammad and Kalsum's 2023 research on product packaging design of Rumah Makan Bonelo, this research is only based on subjectivity through the interview process. This gap indicates the importance of further research to connect packaging design with current consumer needs, while still focusing on an objective and data-driven approach [21].

The purpose of this research is to design the packaging of Cireng Rujak X with appropriate elements based on consumer preferences to become a package. Cireng in the form of a 3D mock-up. Consumer preferences in design can increase customer satisfaction and brand loyalty [11]. So it is hoped that the results of the packaging redesign can increase product competitiveness [12]. Addition, this research also aims to enrich the literature on packaging design by emphasizing the importance of integration between functional and emotional aspects in the design process.

The hope of this research is to come up with a packaging design that not only meets quality standards but is also able to attract consumers' attention emotionally. Thus, Cireng Rujak X is expected to be more desirable to the market, increase customer satisfaction, and ultimately strengthen the brand's position in the frozen food industry [13]. This research is also expected to contribute significantly to the development of

marketing strategies based on innovative and objective packaging design.

### Method

This research applies a quantitative approach with the Kansei Engineering method supported by Quantification Theory Type-1 (QTT- 1) which is a systematic approach to connect consumers' emotional perceptions with the design elements of Cireng Rujak X Frozen food products. The QTT-1 method is able to analyze the relationship between elements and design concepts [7][8][12]. The main focus in this research is to identify packaging design elements, such as color, shape, typography, and illustration, which are able to reflect certain impressions and emotions in accordance with consumer expectations [20]. Thus, this approach aims to produce packaging designs that are not only functional but also have a strong emotional appeal, so as improve consumer experience and product competitiveness in the market.

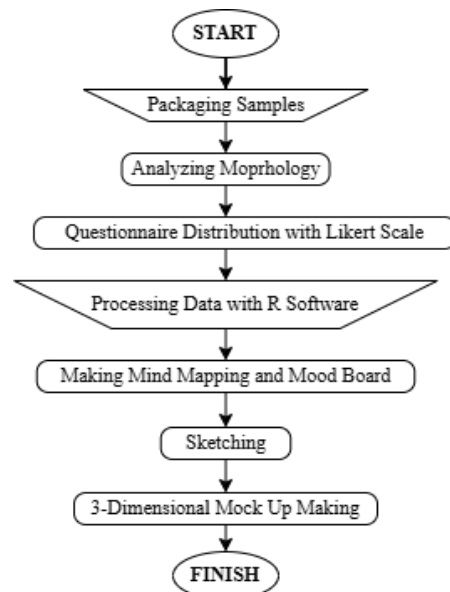


Figure 1. Flow of Research Methods

### Packaging Samples

The process of extracting packaging elements begins with collecting a variety of packaging samples to expand consumer preferences [14][7]. The samples are then analyzed based on Kansei words obtained through the distribution of open-ended questionnaires using the Purposive Sampling method. The results of the Kansei words obtained were then redistributed with a Semantic Differential questionnaire to capture the emotions of respondents [12]. The collected Kansei words were then analyzed using Principal Component Analysis (PCA) to reduce data

dimensions and identify design patterns that match consumer preferences [8]. Furthermore, analyzing the results of PCA data to become a concept.

### **Analyzing Morphology**

Each packaging sample was analyzed in terms of its morphology to identify and determine the elements of the entire design with the help of expert panelists [12]. The design elements that have been identified from each sample will later be used as the main material in the analysis process carried out using the QTT-1 method.

### **Questionnaire Distribution with Likert Scale**

The design concepts obtained were then evaluated based on the packaging samples that had been collected previously. The evaluation process was conducted using Likert scale-based open questionnaire, which has a range of values from 1 to 7 [12]. The required respondents are at least 30 respondents, the data obtained will be sufficient to calculate the validity value of the instrument used in the study [15].

### **Processing Data with R Software**

The relationship between design elements and packaging concepts was analyzed using Quantification Theory Type 1 (QTT-1) with data obtained through a Semantic Differential questionnaire on a 7-point scale (1 to 7). This analysis aims to measure the emotional relationship between the packaging concept in each sample and a specific packaging concept pair [12]. The questionnaire data was then processed together with the results of the design element analysis using R software with the QTT-1 method [8]. The results of this processing resulted in recommendations for the most suitable design concepts and design elements to be applied to product packaging.

The concepts that have been obtained are then analyzed using a sample taken through a Likert questionnaire given to 30 respondents using the Purposed Judgment Sampling method [19]. Sampling using the Purposed Judgment Sampling method, at least 30 respondents must be obtained. The purpose of using Purposed Judgment Sampling is to select respondents who are in accordance with the research objectives [16].

The Likert questionnaire data is then calculated with the application of QTT-1 to become the output data used for the running process with R software. The running process produces data in

the form of histograms, where the highest bar value in each category indicates the type that affects consumer preferences, then the data is adjusted to the morphological input data [14]. The recommended concept results have the highest Multiple R-squared value [14].

### **Making Mind Mapping and Mood Board**

The process of creating mind mapping and mood boards was carried out using Canva software because it provides various features and attractive displays to facilitate visualization of ideas. This software also supports team collaboration, so that the creation of mind mapping and mood boards can be done together. This concept was first introduced by Tony Buzan, who explains that mind mapping can increase creativity and understanding by presenting ideas in a more structured and visually appealing format [17].

### **Sketching**

The sketching stage aims to realize the design ideas that have been analyzed into the initial visual form on the mind mapping and moodboard. Sketches become an initial representation of selected design elements, such as shapes, colors, typography, and materials, which will be further developed in the creation of 3D mockups. Sketching is done manually, drawing it on paper according to the selected concept. In the field of design education, sketching acts as a communication medium that makes it easier for students and designers to design and express visual concepts [18].

### **3-Dimensional Mock Up Making**

After the design elements are selected based on the analysis results, the next step is to realize the concept in the form of a 3D mockup. This stage aims to validate the design elements that have been determined, both in terms of aesthetics, function, and color adjusted to consumer perceptions. The results of PCA (Principal Component Analysis) analysis become the main guide, for example, if consumers prefer pouch-shaped packaging with aluminum material, the mockup design will be adjusted to these preferences. The mockup is designed using Blender software to ensure that each design element is drawn accurately and in accordance with the results of the previous analysis.

### **Results and Discussion**

The packaging of Cireng Rujak X was chosen as the object of research that was developed using the Kansei Engineering method. The process of

extracting elements in the packaging design involves several stages, namely: (1) Analyzing Morphology, (2) Evaluating Concept with Likert Questionnaire, (3) Correlation Analysis of Design Concept with Packaging Design Elements, (4) Making Mind Mapping and Mood Board, (5) Sketching, and (6) Making 3-Dimensional Mock Up.

### Packaging Samples

This study took samples from various similar products of Cireng Rujak X that already exist in the market (Figure 2).


























Figure 2. Packaging Samples

After sample collection, relevant kansei words were identified based on the results of the purposive sampling open questionnaire distribution. The kansei words were then analyzed using the PCA method to identify the design patterns that best suit consumer preferences. Based on the results of the PCA data, 3 pairs of PC (Principal Component) were generated, namely PC 1 "Unprotection-Simple", PC 2 "Standard-Protection", and PC 3 "Unfunctional-Informative".

### Analyzing Morphology

Morphological analysis was carried out by identifying design element components and several factors found in 44 packaging samples through discussions with expert panelists. The results obtained are eight design element factors, including lid, shape, fiture, material, volume, design style, surface design, label design.

**Table 1.** Analyzing Morphology

	X1 Lid	X2 Shape	X3 Feature	X4 Material	X5 Volume	X6 Design Style	X7 Surface Design	X8 Label Design
Type 1	Sealer (X1, 1) 	Standing Pouch (X2, 1) 	V-cut (X3, 1) 	Plastic PET (X4, 1)	Small (X5, 1)	Fun (X6, 1)	Direct Printing (X7, 1)	Informative (X8, 1)
Type 2	Threaded Cap (X1, 2) 	Box (X2, 2) 	Ziplock (X3, 2) 	Plastic PP (X4, 2)	Medium (X5, 2)	Simple (X6, 2)	Label or Sticker (X7, 2)	Semi Informative (X8, 2)
Type 3	Snap On (X1, 3) 	Tray (X2, 3) 	Ziplock + V-cut (X3, 3) 	Plastic PA (X4, 3)	Large (X5, 3)	Minimalist (X6, 3)		Uninformative (X8, 3)
Type 4	Pop Up (X1, 4) 	Center Seal (X2, 4) 	Perforasi (X3, 4) 	Multilayer (X4, 4)		Kompleks (X6, 4)		
Type 5	Wrap (X1, 5) 	Pillow Seal (X2, 5) 	Ziplock + Perforasi (X3, 5) 	Duplex (X4, 5)		Modern (X6, 5)		
Type 6	Hinged Cap (X1, 6) 	Bucket (X2, 6) 	Aerohole (X3, 6) 	Kraft Food Grade (X4, 6)		Ilustratif (X6, 6)		
Type 7	No Lid (X1, 7)	Cylinder (X2, 7) 	V-cut + Aerohole (X3, 7) 	Carton Board (X4, 7)		Colorful (X6, 7)		
Type 8		Flat Bottom (X2, 8) 	Window (X3, 8) 	Aluminium Foil (X4, 8)		Traditional (X6, 8)		
Type 9		Folding Box (X2, 9) 	No Feature (X3, 9)			Elegant (X6, 9)		

**Questionnaire Distribution with Likert Scale**

The Likert scale questionnaire was measured with a range of 1 to 7 for the 44 predefined samples. Each statement represents a variable relevant to the three design concepts of "Unprotection - Simple", "Standard - Protection" and "Unfunctional - Informative" (Figure 5).



**Figure 3.** Likert Questionnaire

The questionnaire was given to 30 respondents online and offline to ensure broad and representative participation [12]. The data obtained were then analyzed to calculate the minimum, maximum, mean, and standard deviation values which will be used as input data for QTT-1 analysis with R software.

**Processing Data with R Software**

The running process requires the average value of 30 respondents, which will be correlated with the morphology result data as input data (Table 2).

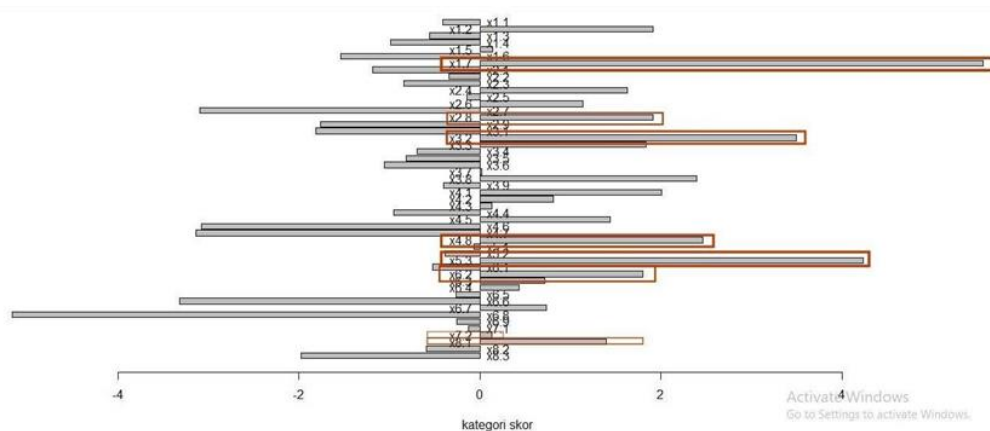
**Table 2.** Questionnaire data processing results

No.	Design Characteristic	No.	Design Characteristic
1.	Green	12.	Center seal
2.	Square	13.	Seal
3.	Aluminium foil	14.	Euro hole
4.	Full design	15.	Blue
5.	V-Cut	16.	Yellow
6.	White	17.	Rectangle
7.	Plastic	18.	Folding box
8.	Browiesh	19.	Duplex laminate

- 9. Label
- 10. Ziplock
- 11. Red
- 20. Vacuum seal
- 21. White yellowish

The running process produces data in the form of a histogram, where the highest bar value in each category indicates type that influences to preferences consumer desires [14]. Based on (Table 3), it is concluded that the recommended concept is PC1 "Unprotection- Simple" with the highest Multiple R-squared value of 0.921.

The results of the design elements for the "Unprotection-Simple" concept are known through the histogram graph (Figure 6). In the histogram graph there are two sides, right and left, the right side displays the elements selected for the Simple concept, while the left side shows the elements for the Unprotection concept. In this research, the mockup to be developed is a packaging design with the Simple concept (Table 3) based on the results of the highest value or longest bar on the histogram graph. After that, the results of the longest histogram bar data are correlated by the morphology result data (Table 1).



**Figure 4.** QTT-1 Running Results "Unprotection-Simple" Concept

**Table 3.** Selected Design Elements based on QTT-1

Elemen Design	Type	PCC
Lid (X1)	No Lid (X1, 7)	0.9379
Shape (X2)	Flat Bottom (X2, 8)	0.92293
Feature (X3)	Ziplock (X3, 2)	0.89446
Materia (X4)	Aluminium Foil (X4, 8)	0.91612
Volume (X5)	Large (X5, 3)	0.88836
Design Style (X6)	Simple (X6, 2)	0.90372

Surface Design (X7)	Label or Sticker (X7, 2)	0.20884
Label Design (X8)	Informative (X8, 1)	0.87847

The results of the QTT1 analysis also produced Partial Correlation Coefficient (PCC) values that indicate priorities in packaging development. The higher the PCC value, the more important the design element is in the "Unprotection-Simple" concept.



## Making Mind Mapping and Mood Board

Mind Mapping is a visual method designed to assist individuals in structuring, organizing, and remembering information [17].

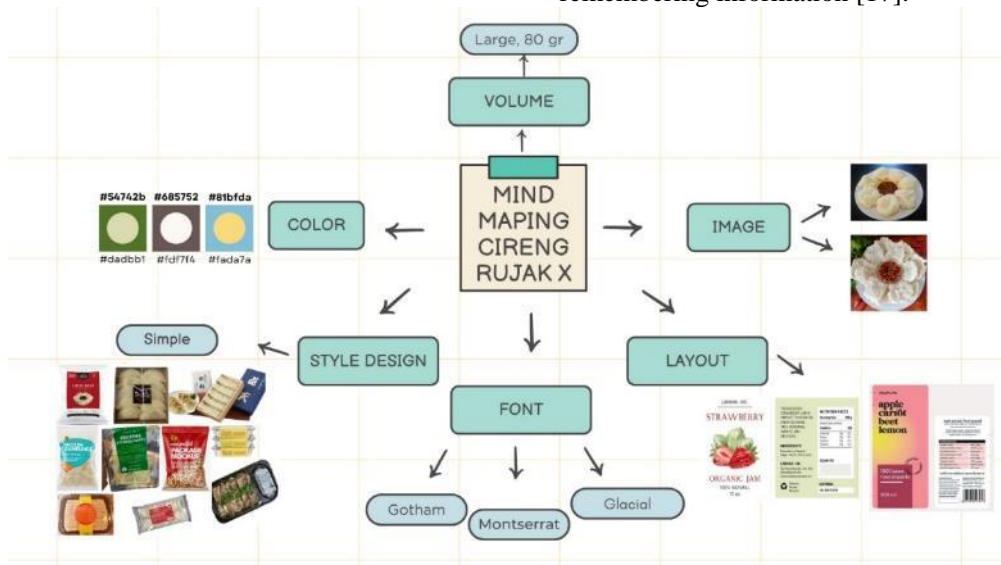


Figure 5. Mind mapping and Mood board

While a moodboard is a visual collage containing inspirational elements, such as images, colors, textures, fonts, and objects, to convey the desired atmosphere or design concept. Making mind mapping and moodboard using Canva Software.

### Sketching

Sketches are visual images used in the design process to convey initial ideas.



Figure 6. Results of Packaging Design

Sketches sketching done manually manual as a reference for designers in making digital mockups, exploring creative ideas, and conducting visual analysis of the objects being developed [18].

### 3-Dimensional Mock Up Making

Based on the QTT-1 results, the mock-up to be created has a "Simple" design style with the highest M-Square value of 0.921. The results of this QTT-1 are very harmonious and successful in getting design elements that are in accordance

with the kansei word determined at the beginning, such as the presence of a ziplock feature, using labels, made of aluminum foil, rectangle shape and several design color choices such as green, browiesh, white yellowish. The kansei word obtained, which describes the taste of the product as delicious, savory, chewy, salty, and crunchy.

Table 4. Packaging Characteristics Design Table

No.	Design Characteristic	No.	Design Characteristic
1.	Green	12.	Center seal
2.	Square	13.	Seal
3.	Aluminium foil	14.	Euro hole
4.	Full design	15.	Blue
5.	V-Cut	16.	Yellow
6.	White	17.	Rectangle
7.	Plastic	18.	Folding box
8.	Browiesh	19.	Duplex laminate
9.	Label	20.	Vacuum seal
10.	Ziplock	21.	White yellowish
11.	Red		



**Figure 7.** 3-Dimensional Mockup Result

### Conclusions

This research successfully developed a packaging design for Cireng Rujak X with a Kansei Engineering approach supported by the Quantification Theory Type-1 (QTT-1) method. The main focus of the research was to understand consumers' emotional preferences towards packaging, resulting in a design that is not only functional but also has emotional appeal. The design elements identified to best suit consumer preferences include: No Lid, Flat Bottom, Ziplock Feature, Aluminum Foil Material, Large Volume, Design Style Minimalist, Surface Design using Labels or Stickers, Labels with Informative Information.

The chosen design concept, "Simple", showed an optimal fit with consumer preferences. The design process involved the creation of mind mapping, mood boards, sketches, and 3D mock-ups using several software to ensure the suitability of the design elements with consumer expectations.

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### Author Contributions

NPS: Conceptualization, methodology writing, analysis, supervision, and review, DFI: Design visualization and questionnaire development, FY: Experimental data collection and data coding, NNW: Morphological table creation, morphological analysis, and documentation, DFI, FY, NNW: Journal editing, methodology, results analysis, and discussion, as well as drawing conclusions. All authors have read and approved the final manuscript.

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